4.5 Max/Min Problems

EXAMPLE 3 Selecting a strategy to determine when a quadratic function reaches its minimum value

The cost of running an assembly line is a function of the number of items produced per hour. The cost function is $C(x) = 0.28x^2 - 1.12x + 2$, where $C(x)$ is the cost per hour in thousands of dollars, and x is the number of items produced per hour in thousands. Determine the most economical production level.

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4.5 Max/Min Problems

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Ex 3 p 237 minimum (vertex)

x = items thousands

C(x) = cost thousands $

$C(x) = 0.28x^2 - 1.12x + 2$

$C(x) = 0.28(x^2 - 4x) + 2$

$\left(\frac{4}{2}\right)^2 = 4$

$C(x) = 0.28(x^2 - 4x + 4 - 4) + 2$

$C(x) = 0.28\left[(x-2)^2 - 4\right] + 2$

$C(x) = 0.28(x-2)^2 - 1.12 + 2$

$C(x) = 0.28(x-2)^2 + 0.88$

$(2, 0.88)$

The minimum cost of production is at 2000 items at a cost of $880/hr.

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The demand for a new product is p(x) = -5x +39 , where P(x) is the price of the item in thousands of dollars and x is the # of items sold in thousands.
The cost function for this product is
C(x) = 4x +30 where C(x) is the cost of the item in thousands of dollars and x is the # of items sold in thousands.

What is the maximum profit for this product?

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What quantity of items must be sold for the maximum profit?

What is the maximum profit?

Profit = Revenue − Cost

Profit = x(price) − cost

Where x = # of items sold

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Profit = x(price) − (cost)

profit = $x(-5x + 39) - (4x + 30)$

profit = $-5x^2 + 39x - 4x - 30$

profit = $-5x^2 + 35x - 30$

$\left(\frac{7}{2}\right)^2 = (3.5)^2$

$= -5(x^2 - 7x) - 30$

$\frac{49}{4} = 12.25$

$= -5(x^2 - 7x + 12.25 - 12.25) - 30$

$= -5\left((x - 3.5)^2 - 12.25\right) - 30$

$= -5(x-3.5)^2 + 61.25 - 30$

$= -5(x-3.5)^2 + 31.25$

$= -5\left(x - \frac{7}{2}\right)^2 + \frac{125}{4}$

$\left(\frac{7}{2}, \frac{125}{4}\right)$ $(3.5, 31.25)$

At 3500 items sold, the company will maximize profit at $31 250

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Hmk

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q 1,2, 3,5,6, 8,9 & 11

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$$R(x) = -x^2 + 10x + 3000$$
$$= -1(x^2 - 10x) + 3000$$
$$= -1(x^2 - 10x + 25 - 25) + 3000 \quad \left(\frac{10}{2}\right)^2$$
$$= -1[(x-5)^2 - 25] + 3000 \quad 25$$
$$= 1(x-5)^2 + 25 + 3000$$
$$= -1(x-5)^2 + 3025$$
$$(5, 3025)$$

Increase the price by 50¢ (5x 0.1) to max revenue at $ 3025

$5.50 per package × 550 items

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3) $h(t) = -4.9t^2 + 1.5t + 17$

When is the diver at 5m

$$5 = -4.9t^2 + 1.5t + 17$$
$$0 = -4.9t^2 + 1.5t + 17 - 5$$
$$0 = -4.9t^2 + 1.5t + 12$$
$$0 = +4.9t^2 - 1.5t - 12$$

$a = 4.9$
$b = -1.5$
$c = -12$

$$\frac{-(-1.5) \pm \sqrt{(-1.5)^2 - 4(4.9)(-12)}}{2(4.9)}$$

$$\frac{+1.5 \pm \sqrt{2.25 + 235.2}}{9.8}$$

$$\frac{1.5 \pm \sqrt{237.45}}{9.8}$$

$$\frac{+1.5 \pm 15.4}{9.8}$$

$$\frac{1.5 + 15.4}{9.8}, \quad \frac{1.5 - 15.4}{9.8}$$

$$\frac{16.9}{9.8}, \quad -\frac{13.9}{9.8}$$

$= 1.7$, -1.4 non relevant (-ve time

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